WHAT IS CLAIMED IS:

1. A turbidity detecting apparatus for on-line monitoring biological substance concentration in a dynamic environment, comprising:

a container that can hold a biological liquid medium and at least a part of its wall is optically transparent.

a detecting probe mounted outside of said container comprising at least one light emission source and at least one photodetector; wherein means for the photodetector to directly detect scattered or transmitted light by the biological liquid medium in the container when the emitted light beam from the light source strikes and interacts with the liquid medium through the transparent part of the container.

an electronic module that comprising analog signal and digital data processing means for the signal from the detecting probe, and displaying related data.

2. A turbidity detecting apparatus of claim 1, wherein the detecting probe further includes a container fixture, wherein means for holding the liquid medium container firmly without any relative movement with respect to the detecting probe when the turbidity measurement is being carried out.

3. A turbidity detecting apparatus of claim 1, wherein the light emission source in the detecting probe comprising a laser diode and a focus lens to generate a light beam; wherein the photodetector is a photodiode.

4. A turbidity detecting apparatus of claim 1, wherein the electronic module includes an analog-to-digital converter, an embedded microprocessor and display unit.

5. A turbidity detecting apparatus of claim 1, wherein the electronic module includes an analog-to-digital converter and a computer.

6. A turbidity detecting apparatus of claim 1, wherein the liquid medium container for biological culture has a volume between 50ml and 5000ml.

7. A turbidity detecting apparatus of claim 1, wherein the medium container is an ordinary and transparent Erlenmeyer flask with a volume between 50ml and 5000ml.

8. A turbidity detecting apparatus of claim 1, wherein the biological substance is microorganism or cells in a biological culture broth.

9. A turbidity detecting apparatus of claim 2, wherein the dynamic environment is a biological culture environment in a biological culture incubator/shaker that including a shaking platform, an electrical motor, shaking speed control unit, and the probe is mounted on the shaking platform.

10. A turbidity detecting apparatus of claim 9, further including one or more the detecting probes and a signal relay module means for transferring signals between the multiple probes and the electronic module via wires or wireless means.

11. A turbidity detecting apparatus of claim 9, wherein the probe and the electronic module are integrated in the incubator/shaker, and wherein further includes means for controlling and regulating the shaking speed and temperature of the incubator/shaker based on measured biological substance concentration in culture broth.

12. A method for real-time and on-line monitoring biological substance concentration in a dynamic environment, that comprising the steps of

utilizing a container to hold a biological liquid medium and at least a part of wall of the container is optically transparent.

positioning a light emission source relative to the container transparent wall and irradiating light beam through and interacting with the biological medium even the medium is agitated.

positioning and aiming a photodetector to detect light from the interacting area of the biological mediu.

positioning both the light emission source and the photodetector outside of the medium container.

fixing the position of the medium container with respect to that of the light emission source and the photodetector when measurement occurs.

providing analog signal and digital data processing means to process the signal from the photodetector and evaluate the biological substance concentration.

13. A method of claim 12, wherein means for positioning and aiming the photodetector to detect the scattered light from the interacting area of the biological medium and that area is the entry or near entry area of the emission light entering the medium.

14. A method of claim 12, comprising a further step of incubating biological substance in the container.

15. A method of claim 12, further comprising means of reducing light scattering effect from air-medium interface by arranging the incident position and angle of the emitted light beam around the bottom corner of the medium container without going-through the air-medium interface.

16. A method of claim 14, wherein the dynamic environment is a biological culture environment in a biological culture incubator/shaker, and further comprising means of mounting the light emission source and the photodetector in said culture environment.

17. A method of claim 14, further comprising means of using digital signal processing algorithms such as filtering and averaging to reduce the fluctuation noise from ambient light, biomass non-uniform density distribution, bubble and air-medium interface scattering effects when the biological medium is under a continuous agitation.

18. A method of claim 12, including a further step of reducing ambient background light influence by shielding the medium container with a dark cover.

19. A method of claim 12, further including calibration and optical density conversion that comprising the steps of

making at least two set measurements on the turbidity value from the detecting apparatus and the optical density from a spectrophotometer for the biological substance with different concentration.

using the microprocessor to calculate the coefficients of a pre-defined equation based on the above measurements, wherein the number of the measurement set should be equal to or larger than the number of the coefficients.

making the optical density conversion for measured turbidity based on the equation with the calculated coefficients.

20. A method of claim 19, wherein the pre-defined equation is a low order polynomial equation.

21. A turbidity detecting apparatus for detecting biological substance concentration, comprising:

a biological liquid medium container has a volume between 50ml and 5000ml and at least a part of its wall is transparent.

a turbidity detecting probe mounted outside of the container comprising at least one light emission source and at least one photodetector; wherein means for the photodetector to directly detect scattered light by a biological medium in the container when the emitted light beam from the light source strikes and interacts with the biological medium.

a signal processing module for analog signal and digital data processing and display, that including an analog-to-digital converter, a digital microprocessor and a display unit.

22. A turbidity detecting apparatus of claim 21, wherein the detecting probe further including a reference photodetector and a differential photodetector electronic circuit; wherein means for compensating the emission light intensity change and the photodetector sensitivity change due to thermal drift.

23. A turbidity detecting apparatus of claim 21, further including a pulse generating circuit and a pulse gated signal detection circuit; wherein means for generating light pulse beam from the light emission source; wherein means for distinguish the signal of the photodetector between pulse-on and pulse-off.